USDA NRCS
Natural Resources Conservation Service

Environmental Considerations for Design and Construction of Poultry and Livestock Shelters

Alabama Guide Sheet No. AL 313C

General Information

Animal waste is stored in animal shelters of animal feeding operations until it is removed for treatment or utilization. An animal shelter can be a swine house, dairy barn, poultry house, or other structure used to house animals in production agriculture. These shelters (buildings) should be properly designed and constructed to ensure the waste has no adverse effects on the surrounding environment (ground and surface water) and also minimizes odors.

In general, the service life and durability, foundation, structure loading, and structural design, should be in accordance with NRCS Conservation Practice Standard 313- Waste Storage Facility. Additional criteria for holding tanks in 313 should also apply to animal shelters that temporarily store liquid waste. Some of the main environmental factors to be considered in the design and construction of these shelters are as follows:

Location: Adequate separation distance is necessary to ensure potential odors from the facility do not become a problem (see NRCS Guide Sheet AL 312, Odor Control for Animal Feeding Operations). As a minimum, newly constructed poultry and livestock shelters are to be located according to the setback requirements as defined in the Alabama Department of Environmental Management Administrative Code, Chapter 335-6-7, as amended (AFO/CAFO Rule).

Shelters should be located on uplands and away from floodplain areas and drainage ways where environmental problems could result. Shelters should be properly oriented to minimize odor. That is, exhaust fans should not be directed at roads or adjacent non-owner dwellings. The animal shelter should be located at least 100 ft. from any on-farm well or 300 ft. from any other well.

Foundation Preparation: Excavation and earthfill operations are required to prepare the site for the construction of the facility. Excavated soil material is often used as earthfill; however, any unsuitable excavated material (organics) should not be used in the earthfill. When earthfill will be supporting structural components of the facility, the excavation or borrow material used as earthfill should be laboratory tested. The test will determine the degree of compaction required to ensure the materials do not settle or consolidate excessively due to loads and cause structural damage to the shelter. Most earthfills will consolidate and settle after construction, even if the compaction of the fill material is performed properly. When a shelter is placed on a foundation that is excavated in one area and has deep fill in other areas, the shelter should be designed to allow for the effects of this differential settlement.

While testing will determine the required compaction, generally, earthfill is compacted to at least 95 percent Standard Proctor density according to ASTM D698, Method A. The designed compaction must also be tested and verified during construction. Each uncompacted lift of earthfill should not exceed 9 inches. Moisture content should be maintained during construction to $\pm$ 2 percent of optimum moisture.

The earthen floors of poultry houses should be constructed of the most clayey material on site to ensure potential groundwater contamination does not occur.

Concrete: Concrete used to contain waste is to be designed according to American Concrete Institute

criteria (ACI 318 and 360) to support anticipated loads and to be impervious. Large slab-type pours should require water stop construction joints between pours and at intervals consistent with ACI criteria. Concrete tests should be performed during the pour to verify the strength and durability of the concrete. Placement of concrete should be according to ACI criteria. Concrete should be vibrated or rodded properly to prevent honeycombing from occurring. All honeycombed areas must be properly repaired. Surface treatments should be required to ensure water tightness.

Concrete slabs of shelters constructed in high shrink/swell soils (blackland prairie soils) will require a foundation of sand and/or coarse material to prevent the concrete from cracking.

Wind and Snow Loads: Shelters damaged from wind or snow could release waste into the environment and often results in a mass die-off of animals that must be properly disposed of (see NRCS Guide Sheet AL 317B, Emergency Disposal of Dead Animals). Shelters should be designed to withstand the anticipated wind and snow loads for the location in the state the shelter is constructed. South Alabama has higher wind loads while North Alabama has higher snow loads. Proper design and construction techniques allow the shelter to remain undamaged during normal weather conditions. Wind and snow loads for design should be in accordance with ASAE EP288.5, Agricultural Building Snow and Wind Loads.

Plumbing: Plumbing for the facility must be properly designed with safeguards against ruptures and leaks. Excess water into an animal shelter can result in possible environmental consequences. Dry waste can become wet waste and be harder to handle, while a wet waste system can have more liquid than the system is designed to handle. Ruptures of waste handling pipes can result in direct discharge to the environment.

Ventilation: Proper ventilation design within the animal shelter optimizes animal health and minimizes odor emissions. Ventilation design should be in accordance with ASAE EP270.5, Design of Ventilation Systems for Poultry and Livestock Shelters.

Erosion and Sediment Control: An erosion and sediment control plan should be developed for the facility to minimize erosion during construction. The finished surfaces should be shaped to provide positive drainage from the animal shelter. All the disturbed area for the construction of the animal shelters should be established to permanent vegetation according to NRCS Conservation Practice Standard, Code 342 - Critical Area Planting.

Design Approval: Animal shelter design, construction plans and specifications, and construction approval should be signed and sealed by a registered professional engineer in the State of Alabama.

Operation And Maintenance

Animal shelters should be regularly inspected to ensure all the design features, which protect the environment, are functioning properly. Pipes which convey waste should be regularly inspected to ensure any leaks are immediately repaired. Any cracks in concrete or leaks in the plumbing, which could release waste, should be immediately repaired. Dust within the shelter is known to contribute to odors and should be controlled or removed.

References

NRCS AL Conservation Practice Standard:
- Code 342 - Critical Area Planting
- Code 313 - Waste Storage Facility

AL NRCS Guide Sheets:
- AL 317B - Emergency Disposal of Dead Animals
- AL 312 - Odor Control for Animal Feeding Operations

Alabama Department of Environmental Management Administrative Code, Chapter 335-6-7, as amended.

ACI 318, Building Code Requirements for Structural Concrete and Commentary

ACI 360, Practitioner's Guide to Slabs on Grade

ASAE EP288.5, Agricultural Building Snow and Wind Loads

ASAE EP270.5, Design of Ventilation Systems for Poultry and Livestock Shelters

ASTM D698, Test Method For Laboratory Compaction Characteristics of Soil Using Standard Effort

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